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OBSERVATIONS ON THE APPLICATION OF CHEMISTRY TO PHYSIOLOGY, PATHOLOGY, AND PRACTICE.

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As delivered by him, in the Gulstonian Lectures, at the College of Physicians.

Lecture I.

Introductory Remarks—Reasons why Chemistry has hitherto been applied with so little success to the medical sciences.

The organic agent employs material elements and agents without changing their nature—Reasons for this opinion.—Difference between organic and inorganic bodies.—Influence of minute quantities of foreign bodies upon common chemical and organic action—Mr. Herschel's Experiments—The action of Miasmata, &c. referred to this principle.

Consideration of the modes in which Chemistry regarded as a science and as an art can be best applied to the purposes of Physiology and Pathology—Conclusion.

The subject on which I have the honour of addressing you is one of great interest, and daily becoming of more and more importance to the physiologist and pathologist; namely, the consideration of how far chemistry can be applied to physiology and pathology, and of the modes by which the inexhaustible powers of this science can be best directed, so as to ensure its utmost advantages.

In the present state of physiology and pathology, if we scrutinize closely our notions and reasonings, on almost any subject, we shall find them, for the most part, to be either purely mechanical or metaphysical. The human mind, in its pursuit after truth, quits with reluctance the dominions of quantity, and hence is too apt to push its laws far beyond their legitimate boundaries. A few of the phenomena presented by living organized bodies are obviously of a mechanical nature; but do we reason justly, in the great majority of instances, when we attempt to explain the most complicated phenomena by the assumption of a little more or less blood, or other fluid; by the presence of enlarged or contracted vessels or apertures; by diminished, excessive, or deranged vascular power or action, and a variety of similar circumstances? Or are our notions of the operations of remedies expressed by such terms as evacuants, deobstruents, tonics, &c. all having reference to mere quantity, either in mass or power, a whit more satisfactory? On the other hand, when we quit material grounds, and launch into the wide ocean of metaphysics, all is fancy and hypothesis; and nervous power, nervous irritability, morbid and healthy, nervous sympathy, and a host of other terms of similar character, are for the most part mere words, to which no two individuals attach exactly the same meaning, and which often have no meaning at all, but are nothing more nor less than a technical gloss to cover our ignorance.

Now between these two extremes—the purely mechanical on the one hand, and the purely metaphysical on the other—there lies an immense chasm, in which is included by far the greater proportion of those important changes which take place in organized beings. The nature of these changes, and of the laws by which they are conducted, have

probably no exact prototype among those of inanimate bodies, but they are obviously most nearly allied to the changes and laws of common chemistry: accordingly, chemistry, from its earliest dawn as a science, has been eagerly pressed into the service of the physiologist; and chemists of the first talent have laboured most assiduously, and exerted all their powers, to further his views, but hitherto without the expected results; and it must be fairly confessed, that physiology and pathology have derived much less advantage from this branch of knowledge than might have been expected. The reason of this failure no doubt is to be ascribed in part to the difficulty of the subject; but it is no less true, that it has been rendered the more signal by the imperfect manner in which the science has been applied. While chemistry was little more than a branch of natural philosophy, and confined to those who had not studied physiology, what could be expected from it? The utmost that a mere chemist could be supposed to effect, would be to examine an organized body as he would a mineral one, and tell you it was soluble in this and precipitated by that, and so on—all very important information in its way, but unfortunately of a description totally useless to the physiologist, and calculated only to disgust him. Another fatal rock on which those have split who have attempted to apply chemistry to physiology and pathology, has been the hasty assumption that what they found by experiment to be wanting, or otherwise deranged in the animal economy, was the cause of particular diseases, and that these diseases were to be remedied by supplying or adjusting artificially the principle in error. Now, in general, nothing can be more absurd than such reasoning as this; and the physiologist, or pathologist, who adopts facts, and reasons upon them in this manner, as a mere chemist would do, will be almost certainly led astray; and if he be given to castle-building, and construct his airy fabric on such a foundation, he will sooner or later have the mortification of finding it tumble about his ears, and perhaps his own reputation buried in the ruins.

Before he can hope to derive much real benefit from chemistry, the physiologist must turn chemist himself. In conjunction with the phenomena presented by living organized bodies, with which he ought to be thoroughly acquainted, he must carefully study their common chemical properties, their ultimate composition, the laws of their formation and change, and a multitude of other matters which the mere chemist is apt to overlook, or knows not how to appreciate even if he observes them. With information thus acquired, and an ordinarily sound judgment, he will soon discover, on the one hand, what he can *not* do, and on the other, what is really within his power. He will soon discover, for example, that nature will not permit him to officiate as her journeyman, even in the most trifling degree; or in other words, that he is as little able to remedy or supply, in a direct manner, what is amiss or wanting in organic action, as he is to remedy or supply an injured nerve or muscle; and that the only way in which, for the most part, he can hope to influence her operations, is through the indirect agency of those circumstances which naturally possess the power of influencing them, and the management and control of which are, to a certain extent, within his power. Another point which he will do well to shun, is idle speculation on the nature of the living or vital principle of organized bodies. The true and legitimate object of inquiry for the physiologist ought to be, not what this principle *is*, but what it *does*; just as the laws and effects of gravitation are legitimate objects of inquiry; though we know nothing, and probably never shall know any thing, of the principle of gravitation itself. Let us, therefore, in conformity with this view, inquire briefly into the phenomena presented by organized beings.

1. In the first place, with respect to the material elements entering into the composition of organized beings, we may observe that these exist in the world in great abundance in the inorganized state, in which state they possess no peculiarities, but are subject to all the agencies and laws which influence other matters. Organized bodies also are no less capable of being influenced by the same agencies and laws; a fact which seems to shew that the organic principle. in adopting material elements, either cannot, or at least does not, adopt them in the abstract, but adopts the whole together—the material invested with all its natural powers. But as this is a most important point,

which I am anxious to establish, in opposition to a notion I believe very prevalent among physiologists, that the organic principle has the power of detaching matter from its ordinary and natural properties, and investing it with new ones, and thus of radically changing or subverting the laws of common chemical action—I shall endeavour, before we proceed, to illustrate it a little further.

Let us take a mass of sugar, as a familiar example of a substance formed by an organic principle, and which probably will never be formed by any other agency. Sugar has been ascertained, and is generally admitted, to be composed of three elements—hydrogen, carbon, and oxygen, combined together in certain proportions. Now what power, I ask, is it, which, at this moment, keeps the particles of the three elements composing this sugar together in its present state? Will any one contend that it is the organic principle of the plant in which it was formed perhaps many years ago? Would not this supposition be as unnecessary as absurd?—for do we not know that the elementary particles of all bodies, or at least of those which form sugar, possess a natural and inherent affinity for one another—the hydrogen, for example, with the carbon, or with oxygen, or both? And are not these natural affinities among its component particles quite sufficient to account for at least its present existence? If this supposition be admitted, must we not be likewise compelled to admit that this sugar has *always*, from the moment of its first formation in the cane, existed, in virtue of the same natural affinity, among its particles? And, to push the argument still further, must we not suppose, in this case, that, even at the moment of its formation, the organic principle of the plant, if it exerted any, must have exerted powers *absolutely identical* with those which now keep its particles together?

We have reduced the argument, then, to this state: in the immediate formation of sugar, either the organic principle did *not* impart any new power whatever to the particles of which it is composed, and causing them to combine together, or it imparted to them a power absolutely identical with those they already possessed, and which naturally belonged to them. Now the latter alternative is directly at variance with that principle of logic which forbids the assumption of two causes for the production of an effect, when one cause already exists which has been proved, or is known, to be sufficient for that purpose. The conclusion, then, from the whole argument, is, that the organic principle of the plant does not at this moment, nor has not at any time, even at the moment of its formation, acted as the cause which keeps the elements of sugar in their present state of union; but that they first combined, and still remain in union, in virtue of the natural and inherent affinities existing among the particles of which it is composed; and the same argument, with some modifications, may be extended to all organic compounds.

2. But organic compounds in general *do* differ very much, in their sensible and other properties, from those of the inorganic kingdom; we have, therefore, to inquire briefly, in the second place, into the nature and reason of these differences. Organized bodies in general do not crystallize; instead, therefore, of being bounded by straight lines and angles, they are usually more or less rounded, and their intimate structure is amorphous. Indeed it is a remarkable fact, that no crystallizable body (even water and the saline matters of the blood are doubtful) seems capable of constituting a portion of a living organized being; such products, when they do occur, being either the result of excretion or of disease, or of some artificial process. Thus sugar, above-mentioned, in its crystallized state, is the result of an elaborate artificial process, the object of which is the separation of a number of other matters naturally existing in combination with it in the juice of the cane, and which, as long as they are present, effectually deprive it of the power of crystallization; and, indeed, it has been known, from time immemorial, that all organized bodies, when submitted to combustion, leave minute portions of earthy and saline bodies constituting their ashes. These bodies have been usually viewed as foreign matters accidentally present, but I never could bring myself to subscribe to this opinion; on the contrary, they have always appeared to me to constitute the grand difference between inorganized and organized bodies, and to perform the most important functions; or in other words, that organization cannot exist without them. The following are a few of my reasons for this opinion:—

Every one must have remarked how much the external characters and properties of all substances are liable to be modified by different modes of aggregation, and a slight admixture of foreign matters: this holds good both in the inorganized and organized productions. Thus, what can be more striking than the infinite variety of forms or conditions which common carbonate of lime assumes from these causes? Iceland spar, pure white marble, and common chalk, owe their differences solely to the modes in which their particles are aggregated; but these differences are trifling when compared with the infinite variety produced in the same substance by a slight admixture of other matters. Another familiar instance in which the *properties* rather than the external characters of a body are changed by a minute admixture of foreign matter, is *steel;* which important substance, as every body knows, is essentially composed of iron, combined or mixed with an insignificant proportion of carbon. The modifications, however, produced in the inorganic kingdom are by no means so striking and important as those produced by similar causes in the organic kingdom. In the inorganic kingdom, also, the primary compound in general, as in the instance of carbonate of lime, is fixed and definite in its nature, and thus easily separated from foreign bodies, and made to crystallize as we choose. But in the organic kingdom the case is very different; here the substances, though undoubtedly primarily composed according to precise chemical laws, are naturally so unstable in their condition, and so easily decomposed, that from this cause alone they can, in very few instances, be separated from the contaminating matters, and be obtained in a perfectly pure state.

But it is well known that the foreign bodies met with in organic products are more intimately mixed, and adhere with greater obstinacy to the primary elements, than similar substances in inorganized bodies. They are also, for the most part, so uniform and constant in their character in the same substance, that, whatever office they may be supposed to perform, it is difficult not to believe that it is a most important one, and quite as essential to the existence of the body in its organized condition as the elements of which it is chiefly composed. How these bodies operate is not so easy to explain. That they do not enter into the composition of organized bodies in definite proportions, according to any known chemical laws at least, is evident; and the only notion that, for a long time, I could form to myself on the subject, was, that they perform an office which may be termed *interstitial*—that is to say, that they operate by being interposed, as it were, between the essential elementary atoms of organized substances, and thus prevent them from assuming the crystallized form, in which state they would be totally unfit for the purposes of the economy of living organized beings.

This mechanical explanation of the operation of minute foreign bodies, though probably correct to a certain extent, or as far as it goes, is obviously, however, inadequate to explain *all* the phenomena. Whoever has carefully studied the effects of minute quantities of matter upon common chemical action, and infinitely more upon organic action, must be aware that they often appear to exert energies totally inexplicable upon any known principles. The subject, however, has by no means received the attention it deserves; and, indeed, besides myself, I do not know any one that has attended to it at all—at least in the point of view in which we are considering it here. There is, however, one very important series of experiments made by Mr. Herschel, and published in the Philosophical Transactions for 1824, which struck me at the time as remotely bearing on the subject; and though, in the present state of our knowledge, these experiments can be hardly so applied as to throw much immediate light on the subject, they seem to me to open up a new and important field of inquiry, and to promise to lead hereafter to the most unexpected results.

For the particulars of Mr. H.'s experiments I must refer to his paper, and shall only observe, that he has shewn that an enormous power, not less than 50,000 times that of gravity, may be instantly generated by the simple agencies of common matters submitted to galvanic influence; as, for example, mercury alloyed with a millioneth part of its weight of sodium, &c. That the powers thus capable of being developed are, in some way or other, connected with many of the phenomena and changes presented by organized beings, to an extent far beyond that contemplated by Mr.

Herschel, I have no doubt. We before attempted to shew that, in adopting and employing material bodies, the organic principle adopts and employs also those energies which are naturally associated with them—as the galvanic energy, &c. Now it must follow, I think, inevitably, that if the galvanic energy be made to operate upon bodies constituted, as all organized bodies are, of certain principles alloyed or mixed with minute quantities of foreign matters, that powerful actions of some sort or other must take place; for no one, I presume, will for a moment contend that these effects are confined to mercury. It deserves to be mentioned also, as a curious fact corroborating this supposition, that many of those minute foreign substances which Mr. H. found to exert most energy in his experiments, are precisely those most usually occurring in organized bodies, such as sulphur, phosphorus, magnesium, calcium, iron, &c.; and that the serum of the blood itself is a weak alkaline solution of soda, the very same as that most usually employed by Mr. H. in his experiments. The analogy might be even carried further; but I shall dismiss the subject for the present with a brief enumeration of some of the more important phenomena which seem to derive much elucidation from the views here brought forward. Among these may be mentioned, in the first place, the subtle matters of contagion and miasmata: these, whatever they may consist of, apparently exist in very minute quantity, and evidently operate by deranging or subverting organic action. To these may be added many medicinal substances capable of producing the most extraordinary effects in the smallest doses; the still more refined and recondite matters of light and heat, and a variety of others; all of which produce their effects by the agency of infinitely minute quantities, and that probably by attaching themselves to the principles composing organic bodies; and thus by suspending natural actions, or introducing new ones, influence or destroy life.

After this brief sketch of the nature of organized bodies, as compared with those from the inorganic kingdom, we may perhaps be able to form some notion of the general principles upon which the organic agent operates, and the nature of the influence it exerts in the formation of organic products.

Let us take the same body, sugar, as the subject of illustration. Sugar, as before observed, is made up of three elements, two of which, hydrogen and oxygen, in the simplest state in which we are acquainted with them exist as gases; the other, carbon, as a solid. Now, in operating on these elements in mass, as we are obliged to do in our experiments, I need not say that we have never been able to cause them to combine so as to form sugar; but if, instead of operating upon the elements in mass, we were enabled to contrive an apparatus so constructed as to exclude all foreign agencies, and to bring the particles of each of the elements together in succession, there can be no doubt, from the natural affinity existing among these particles, that they would combine, and that the result would be the identical substance, sugar, the same as it is formed by nature. Now this is exactly the principle upon which all organic processes are conducted. No where do we see the organic agent act upon elementary principles in mass, as we are obliged to do in our experiments, but by the medium of a complicated and minute apparatus, which enables it to operate, as it were, on the ultimate particles of bodies, and by these means to exclude some and to bring others into contact, according to the design in view. With respect to the nature of the organic agent, this view of the subject leads us to the conclusion that in different instances it is endowed with different degrees of power, but that in all cases it must be considered as an ultimate principle, endowed by the Creator with a faculty little short of intelligence, by means of which it is enabled to construct such a mechanism from natural elements, and by the aid of natural agencies, as to render it capable of taking further advantage of their properties, and of making them subservient to its use. Nor does this view of the subject lead to materialism, or otherwise derogate from the wisdom and power of the Deity, but, on the contrary, is calculated to exalt both in our estimation; for is it not more consonant to our notions of infinite wisdom and power to suppose that the Deity created agents and materials originally endowed with all the energies and properties we have assigned to them, than to suppose that he originally created them imperfect, and is every moment obliged, as it were, to perform miracles by subverting

or extending their natural actions and properties? There is yet another advantage resulting from the views here attempted to be established, which I cannot refrain from mentioning before we quit this part of the subject; namely, that by representing organic action as an adaptation and extension of those more obvious changes constantly going on around us, it not only renders them legitimate objects of inquiry, but holds out the rational hope that by industry, and cautiously proceeding, step by step, from the known to the unknown, we may hereafter arrive at the solution of many of nature's mysteries.

We come now in the last place to consider very briefly the modes by which chemistry can be more immediately applied to the purposes of physiology and pathology.

Chemistry, like most other branches of knowledge, may be considered in a twofold point of view—as a *science* and as an *art*. The *science* of chemistry may be supposed to comprehend the knowledge of the primary laws which influence and regulate the combination of bodies, without reference to their common chemical properties;—the *art* of chemistry comprehends the practical knowledge of what is termed the chemical properties of bodies.

The *science* or philosophy of chemistry, I am sorry to say, is very little understood; perhaps no science less so, considering the attention that has been paid to the subject. The atomic theory of Dalton, by connecting chemistry with quantity was undoubtedly the greatest step that has been made in modern times; but by stopping where it did, I am not sure whether upon the whole, the science of chemistry has not been rather retarded by it than advanced: for to suit the imaginary standards of this bed of Procrustes, real results, I fear, have been too often extended or compressed beyond all legitimate bounds, and thus truth sacrificed to error. My notion of the atomic theory is, and always has been, that it does not present a just view of the laws which regulate the union of natural bodies, and consequently that it is inapplicable both to organic and inorganic chemistry. The light in which I have been always accustomed to consider it has been very analogous to that in which I believe most botanists now consider the Linnæan system; namely, as a conventional artifice, exceedingly convenient for many purposes, but which does not represent nature. On the continent, the modification of Dalton's views, proposed by Berzelius, is generally adopted; but this, I fear, is still more imperfect than our own. In spite of this, however, and solely from their industry and practical skill, the Berzelian or continental school of chemists has got the start of us in many respects, and by mere dint of experiment has succeeded in establishing the curious and important doctrines of *isomorphism* and *isomerism*—doctrines totally inexplicable on the principles of Dalton and Berzelius, but which seem to me to flow necessarily, in conjunction with some others, from the principles which I have long considered as regulating the union of bodies in nature.

This is not the place, nor the occasion, however, to enter on the subject of chemical philosophy, even if I were prepared to do it in detail, which I am not; but in order that what follows may be the better understood, it may not be amiss to state very briefly some of the views to which I was led now many years ago, and which are quite at variance with the artificial system at present received, and seem to indicate rather the existence of a more natural system.

1. In the first place, bodies appear to be associated together in natural groups or families, having certain radical laws in common. Thus the three great natural classes or groups, which appear to essentially constitute the groundwork of all organized beings, may be denominated the *saccharine*, the *oleaginous*, and the *albuminous*. An account of the analyses of the principal objects of the first of these great classes, the *saccharine*, has been already published in the Philosophical Transactions for 1827; the other two have not yet been published. The radical law pervading the whole class of saccharine bodies is, that they are essentially composed of carbon and water in different proportions. The radical law pervading the oily bodies, as far as I have yet examined them, is, that they are essentially composed of olefiant gas and water, or have relation to this composition. The radical law of the albuminous class, I cannot yet venture to mention. When the analyses of all these three great classes are completed and published, it is my intention to point out in detail the curious and important results to which they lead; but not till then. In the

meantime it is my wish that the results which have already been, and which remain to be published, shall be thoroughly investigated by others, in order that their errors, if they contain any, may be pointed out, that I may not have the mortification of building my superstructure upon a sandy foundation.

2. The numbers conventionally employed by chemists, and termed atomic weights or chemical equivalents, I am disposed to view in a very different light from that in which they are usually viewed at present. Supposing them to be correct, they no doubt represent in general the quantities in which bodies *most usually combine*, but by no means always. Indeed, they appear to me to be often nothing more than one term of a natural series peculiar to each body, and determining its combination. Thus 9, the number assumed to represent the combining weight of water, is to be considered only as one term of the series 3 : 6 : 9 : 12 : 15: &c., in all which proportions (and perhaps in still lower submultiples of them) this fluid enters into combination, perhaps quite as often as in the proportion 9, especially in the organic kingdom. Chemists have already a glimpse of this important fact when they speak of bodies uniting to others in the proportions of two, three, or more atoms, which, in fact, are nothing more nor less than different terms of a natural series, such as that above alluded to.

This view throws much light on the composition of bodies in general, and at the same time obviates many of those absurdities and false conclusions to which chemists are too often led by adhering to a single term. Thus, in a natural group or family, as the saccharine group for example, by adhering to a single number, as 9, for water, we should be led to fractions of atoms without end; but by considering the carbon as associated with different proportions of water, in terms of the above series (as experiment indicates to be the case) all these absurdities are avoided, and at the same time the existence of a beautiful law is indicated; and in connexion with this point, it may be further observed, that in general, the more simple the relations between the elementary weights, the more fixed and definite the character of the resulting product, particularly if the absolute weights of the elements have likewise a simple relation.

There is reason to believe that bodies, as they descend in the quantitative series, gradually lose their power of contributing to crystalline form, and acquire a merorganizing faculty*: this appears, at least, to be strikingly the case with water (one of the most important and frequent of all the merorganizing principles), which even within limits capable of being determined by experiment, often modifies crystallization very remarkably.

From these observations, which might be much extended, it will appear that before much can be certainly known respecting the real nature of organized beings, the subject of chemical philosophy must be better understood than it is at present, and the ultimate composition of bodies be much more accurately determined. In conjunction, too, with the ultimate composition of bodies, the nature of the merorganizing bodies must be carefully studied. This is an entire new field of inquiry, and one of the utmost importance and curiosity, and will, I have no doubt, hereafter throw no ordinary light on many of nature's operations. We shall then, for example, know why the red particles of the blood are merorganized by iron; why sulphur predominates in birds, phosphorus in fishes, lime in the secretions of the alimentary canal; how magnesia or magnesium is connected with nervous action, at least that of the ganglionic nerves; and an infinite variety of similar matters, the existence even, much less the *modus operandi*, of which is entirely unknown to us.

From the little progress that has been made in the philosophy of chemistry, and its great difficulty, we must be content, I fear, for many years yet to come, with a very limited knowledge of the subject. In the meantime, let us inquire very briefly how far the *art* of chemistry, or the consideration of the chemical properties of bodies, can be best applied to the purposes of physiology and pathology.

I have already said that the physiologist, in order to obtain the utmost advantages that chemistry is capable of contributing, must turn chemist himself, and carry on his researches in connexion with the phenomena of life, of which he must never lose sight for a mo-

* Μέρος, *partim:* see the paper above alluded to, Phil. Trans. 1827, where this term is provisionally adopted and explained.

ment. In the first place, and whenever it can be done, the substance to be examined should be detached from all others, and obtained in a crystalline form. On this part of the inquiry much valuable practical knowledge is to be obtained by a careful study of the essays of preceding celebrated chemists, and particularly of the French chemists, who have pursued this branch of inquiry farther than it has been carried in this country. When a substance cannot be obtained in a crystalline form, which is the case with by far the greater proportion of organic matters, we are obliged to quit altogether the solid foundation of quantity, and take our station among the uncertainties of mere quality, or sensible properties. Now every one must have remarked at the outset of his chemical career that the phenomena presented even by well-defined bodies, when submitted to the action of tests and re-agents, were often very different from what he had been led to expect; and that, from some trifling circumstance or other, he was constantly liable to fall into error; and, in short, in many cases, that it was not till after long and close attention that he was enabled completely to see his way, and separate the essential from the accidental phenomena. Even here, then, much depends upon the operator; and according as his skill and experience are greater or less, so will his statements be more or less entitled to confidence. But if this be the case with fixed and well-defined substances, how much more strikingly so is it with organized bodies—the phenomena presented by which, whether naturally, or as influenced by tests and re-agents, are so delicate and evanescent—so varied and infinite in number, that language is scarcely capable of conveying any adequate idea of them: hence the long and tedious details of precipitations, changes, &c. said to be produced by different re-agents on organic products, are for the most part entirely useless both to the chemist and physiologist, and by multiplying uncertainties, serve only to contribute to error.

Imperfect, however, as this department of chemistry is, and always must be, it is yet capable, when judiciously applied, of contributing much valuable information to physiology and pathology. Great care and experience, however, are necessary on the part of the operator, which alone will give that tact and power of discrimination calculated to enable him to disentangle the intricacies presented to him, and to seize the clue that will lead him to truth. By its aid, for example, the physiologist can often identify the most delicate and refined organic products in a way that cannot be done by any other means, and thus be enabled to detect minute variations from the healthy standard, often of the utmost importance in a physiological and pathological point of view. Another field of inquiry in which this department of chemistry can be usefully applied is, the study of the effects produced by medicinal agents. Many of these, as is well known, often change or modify organic products, and particularly secretions, in a remarkable manner; and when the nature of these changes is understood, they often lead to the most valuable practical inferences with respect to the periods and modes of administering particular remedies. In short, the physiologist, in a great many instances, by the aid of chemistry, can so associate the evanescent and fleeting phenomena of life and of disease with the more tangible and intelligible phenomena of matter, as not only to be enabled to form a more just notion of their nature himself, but to convey it to others; and thus, instead of being obliged to permit the greater part of his knowledge to die with him, to hand it down, in an intelligible form, for the benefit of posterity.

Thus, then, (to recapitulate briefly what has been said) we may consider chemistry to hold a sort of intermediate rank between anatomy on the one hand, and metaphysics or psychology on the other; and by gradually coalescing with both, to connect the whole, as it were, into one great system. Of these extensive branches of knowledge, anatomy, from its obvious and mechanical nature, no less than from the great attention that has been bestowed upon it, is by far the best understood, and scarcely a nerve or fibre, perhaps, remains that has not been again and again demonstrated, so that comparatively little remains to be done in it. On the other hand, if we know little of the nature of living action or psychology, it has not been for want of inclination and attempts to investigate it, but simply from the nature of the subject, which, for the most part, is beyond our comprehension. While, if we turn to the vast and intermediate field, where, by industry and perseverance,

almost every thing is within our power, we find comparatively little done, and very few working. How is this? What is the reason that so important and interesting a branch of knowledge should be so unaccountably neglected, and that our knowledge, in fact, respecting it is little farther advanced than it was 20 years ago? How is it that a physiologist will sit down and rack his brains and invention to push mere mechanical principles to the most improper and absurd lengths; or choose to wander and lose himself in a labyrinth of metaphysical subtleties and errors, rather than attempt the investigation of what, by a little well-directed industry, is completely within his power? The circumstance, I confess, has always appeared to me most unaccountable, though I trust the opprobrium is about to be removed, and that this most important and interesting point of knowledge will soon obtain all the attention it deserves. The subject falls properly and exclusively within the province of the physician, and to the young and industrious aspirant it offers an immense field, where the prizes are many and great, and the competitors few. Mechanical principles, as applicable to physiology, are limited at best, and they have already been pushed as far as they safely can be; but here every thing is new, at least at present, and apparently unlimited; for chemistry, perhaps, more than any other science, depends for its advancement upon the gradual development of human knowledge.

That the physician of another age will be as familiar with the operations of the animal economy as he is at present with its anatomy, I have not the least doubt. The minute and ultimate anatomy is unknown to us—the minute and ultimate chemistry will always probably remain so; but all the great and obvious changes, like the great and obvious parts of the living machine, are within our power, and will be known: and, to push the comparison still further, I will venture to predict, that what the knowledge of anatomy at present is to the surgeon, in conducting his operations, so will chemistry be to the physician, in directing him generally, what to do, and what to shun; and, in short, in enabling him to wield his remedies with a certainty and precision, of which, in the present state of his knowledge, he has not the most distant conception.

COLCHICUM IN RHEUMATISM.

To the Editor of the London Medical Gazette.

Sir,

We have lately had the opportunity in our clinical ward of testing the merits of colchicum in rheumatism, under circumstances (in this country at least) somewhat novel; and as the result is interesting, I send you the following observations for insertion, if you think proper, in your periodical.

I am, sir,
Your obedient servant,
Alex. Tweedie,
Lately Clerk to the Clinical Physicians.

Guy's Hospital, 13th May, 1831.

Though colchicum has long maintained a very respectable rank in the list of our remedial agents for the cure of rheumatism, yet from time to time there have been some who have doubted its efficacy; and even when used with the happiest effects, the result has not been so speedy as to satisfy the sanguine expectations of many of its supporters. Much of this discrepancy of opinion is doubtless ascribable to the notorious fact, that the fluid preparations of the drug are compounded in many different ways by various practitioners—a circumstance of itself sufficient to produce great uncertainty of effect, and in many cases complete disappointment.

Another great cause of failure and uncertainty may perhaps consist in this, that the remedial principle of the drug is probably not entirely taken up by the menstrua in either of our pharmacopœial preparations; so that when the vinum, or the acetum colchici, disappoints our expectations, we are scarcely justified in condemning the drug as useless, whose specific principle has, under such circumstances, never been administered at all, or very partially. To obviate these objections it becomes necessary to administer the remedy *in substance*; and it is to shew the benefit of this plan of exhibition that I have ventured to trouble you with these remarks.

The form of application most commonly, I believe, adopted, and which has for some time past been practised by Dr. Bright in this hospital, is the same as that recommended in a recent number of your Gazette by Dr. Low-